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ABSTRACT

This paper explores the changes that have occurred in computer aided learning in economics and business education between 1983 and 1988. Evidence is presented from interviews with leading software publishers, a survey of colleges in Hertfordshire (England), classroom observations, and interviews with lecturers. The main conclusions are that a wide range of software is currently available and that much of it is more appropriate for the average student than was the first generation of software. However, the existence of an information gap has meant that teachers often do not know about the available software, nor do they necessarily know how to make the best use of it. Economics and business studies students still receive only a handful of hours of computer assisted training per year. Economics teachers are more likely to have their own microcomputers. Ironically, this has not yet led to a significant increase in computer aided learning during the 1980's. Logistical difficulties seem to have hampered such a development. (Author/PPB)

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RECENT DEVELOPMENTS IN COMPUTER AIDED LEARNING: A CASE STUDY

by

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Recent Developments in Computer Aided Learning: A Case Study

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Summary

This paper explores the changes that have occurred in computer aided learning in economics and business education between 1983 and 1988. Evidence is presented from interviews with leading software publishers, a survey of colleges of further education in Hertfordshire, classroom observations and interviews with lecturers. The main conclusions are that a wider range of software is currently available and that much of it is more appropriate for the average student than was the first generation of software. However, the existence of an information gap has meant that teachers often do not know about much of the software that is available, nor do they necessarily know how to make the best use of such software. Economics and business studies students therefore still receive only a handful of hours of CAL per year. Economics teachers are more likely to have their own microcomputers and they consider that potentially, software has become much more useful in recent years. Ironically, this has not yet led to a significant increase in computer aided learning during the 1980s. Logistical difficulties seem, at least in part, to have hampered such a development.

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INTRODUCTION

In this study, computer aided learning refers mainly, though not exclusively, to the use of computers to aid gaming/simulation exercises, for data base purposes and as a means of drill and practice, or programmed learning. These three modes seem to be the most frequently used in the context of school/college courses up to (and including) approximately 'A' level standard.

Many programs that have been used by economics teachers could have been, or actually have been, used by teachers of business studies. Thus the target sample of teachers for the questionnaire reported below comprised both economics and business studies teachers.

The hypothesis that I wish to put forward is that there have been very great changes in computer aided learning in economics and business studies courses over the last five years in courses of an academic standard up to, and including, 'A' level.

Of course it is commonplace to suggest that the world of computer technology is characterised by change, but I am attempting to draw attention to the scale and pace of that change. To illustrate both, consider the simulation Running the British Economy, which Lumsden has run for a number of years, as a competition open to school and colleges throughout the country. In 1980, when the technology available was dominated by remote terminals connected to a mainframe, 29 institutions took part. Three years later, with the spread of micro computers, that number had increased to 373 (Lumsden and Scott, 1983). Such changes have occurred, at least in part, because of the drop in the real cost of computers. Moreover, change has not just been limited to the hardware available: there has been a proliferation of software as well. As recently as 1983, Cotterrell complained that there was a gap in the CAL market, owing to the absence of good software for use with groups studying courses that were less academic than 'A' level economics. Again, in a research paper dated February 1983, Wood wrote:-

> "The most significant recent development in computer-assisted learning (CAL) in economics education in the U.K. at the secondary level has been the production of material for use by economics teachers with their students in schools, resulting from the work of the Schools Council Computers in the Curriculum Project (1973-77)". (Wood, 1983, p.1)

When Wood was writing, the Computers in the Economics Curriculum suite (edited by Killbery and Randall, 1981) was something of a market leader in software material for this part of the curriculum. The target audience for these 10 programs was predominantly the 'A' level/BTEC National type of student. Within the following 2 or 3 years, a number of pieces of software had been published, that were intended for less academic groups: Understanding Economics Pack I (edited by S.J. Hurd, 1985) has been one notable example.

Furthermore, I wish to suggest that the cumulative effect of these changes has been to make CAL methods more useful, potentially at least, to the teacher of economics and business studies. The word 'potentially' is important in this context. Although the amount of hardware and software is growing apace, that is not the same as saying that teachers are actually using CAL methods more often, nor indeed that they ought to do so. I hope to show that the increased availability of computers,

together with the increased quantity and quality of relevant software, has made CAL methods more worthy of consideration, or more useful to the teacher, than they were even as recently as five years ago.

Hurd (1987) has estimated that a typical 'A' level economics student receives just 7 hours of computer time per academic year. This is likely to be a 'generous' estimate, given that it is based upon the replies to a 1985 questionnaire that Hurd sent to over 2,000 teachers, of whom approximately 600 responded. It seems plausible to suggest that those teachers who were interested in CAL methods were more likely to fill in the questionnaire. The sample came from members of the Economics Association, and again, it seems plausible to suggest that the more innovative teachers are likely to belong to such a group. Thus, to generalise about all economics and business studies students, on the basis of such a questionnaire, (as Hurd himself admits), is something one can only do on a tentative basis. It is worth repeating that 7 hours per student per year is a generous estimate, and even that seems to suggest that a very low proportion of an 'A' economics student's time is spent learning the subject with the aid of a computer.

Another aspect of my hypothesis concerns the educational climate of the 1980s. I wish to suggest that there have been a number of radical innovations during this decade which have often tended to support the case for more CAL usage. In the autumn of 1986, schools embarked on GCSE courses for 4th year pupils. The main differences between the 'old' 'O' level or CSE courses and the 'new' GCSE examinations lay not so much in terms of the syllabus content, but rather in terms of the mode of assessment. An important part of all of the new GCSE economics courses was the continuous assessment element; examination boards such as the London 'O' level had previously had no course work element whatsoever. More importantly, the GCSE economics examiners have frequently been at pains to stress that the coursework is not to be viewed as an 'add-on', or 'bolted-on' project. Instead, the course work was to be viewed as a means whereby students could examine a hypothesis for themselves 'in the real world'; this was to be viewed at an integral part of the course. Clearly then, the ability to handle data is crucial to the students. A capacity to apply that data using some economic concept is also likely to be important, as is the skill to formulate a tenable hypothesis. Given these requirements, one could imagine that a computer could be very useful to the student, because the drudgery of manipulating numerical evidence 'by hand', or even calculator, is removed. Students can use several pieces of software, such as data-bases, that will enable them to concentrate on the underlying concepts, rather than spend a long time on the arithmetic of any given exercise.

Another important innovation in the mid-1980's was the advent of the CPVE (Certificate of Pre Vocational Education). The examination boards responsible for CPVE (i.e. BTEC and City and Guilds) have, from the beginning, insisted on a student-centred, problem-solving approach. In a consultative document simply entitled The Certificate of Pre-Vocational Education, the Joint Board state that:

> "The (CPVE) programmes must therefore be based upon the needs, interests and resources of those taking part and must involve activity based experiences." (Joint Board, 1984, p.4)

Again, such a teaching style could, I believe, benefit from CAL usage. I am not suggesting that computers are a necessary and sufficient part of every CPVE module, to the exclusion of other pedagogic styles.

Rather, I am saying that software such as Teddytronic (Carter, 1984) could be used with benefit to develop a number of skills, such as problem-solving or decision making, that are found on a typical CPVE syllabus.

Since its inception in the mid-1970's, the BTEC examining board has been increasingly concerned to promote an integrated, problem-solving approach to its courses, as Cotterrell (1987) has pointed out. It has also recently introduced a unit designed to show the effects of computer technology, in one of its core modules ("The Organisation in its Environment"). Given these changes, many colleges offering the BTEC National courses in Business and Finance have attempted to 'kill two birds with one stone'. These colleges have given the students a financial or economic 'problem' or assignment and expected them to use a software package to solve that problem. The students can then gain valuable experience handling data, or taking part in a computer simulation, and see at first hand the way that micro computers might be used in the business world.

Another innovation of the mid-1980's concerns the advent of Open Learning, and flexistudy courses. It has been recognised that many adults might wish to take advantage of some education or training programme, but are thwarted by their inability to attend a particular institution at a given time every week or month. Domestic or work-related commitments might mean that these adults are unable to attend day-time or even evening class sessions on a regular basis. This explains why the Open Learning scheme has been so keen to develop materials such as programmed learning texts, video cassettes and computer programs, which enable a student to study a given course, away from a college or educational institution. At the moment, there are relatively few programmed learning disks for economics in the U.K., but their number is growing.

The question of CAL's potential utility would thus seem to require considerable empirical research. I wish to examine a range of software that has recently been developed, and attempt to provide some tentative generalisations about the quality of this new software. Moreover, I hope to assess teachers' reactions to this material, in the further education colleges of one county (Hertfordshire). In particular, I wish to use a historical perspective, for some of the analysis at least. I hope to examine what changes have taken place, and see how favourably or otherwise these have been viewed.

The empirical evidence concerning this hypothesis will mainly come from a case study of economics and business studies courses in Hertfordshire colleges of further education. Information to support the hypothesis will come from three sources. Some evidence will come from the replies to the 27 questionnaires sent out to Hertfordshire colleges. I also observed some classes in which CAL methods were used. As a third source of evidence, I interviewed a number of people concerned with CAL materials. Representatives of two publishers were kind enough to see me and answer questions; this provided a useful perspective to analyse some of the changes that have taken place. I also followed up the classroom observation by asking the teachers concerned some questions about computer materials.

EVIDENCE FROM THE PUBLISHERS

I now wish to consider the comments made by representatives of two publishers, regarding CAL materials in this area of the curriculum. In October 1987, a representative of a major software publisher was kind enough to see me and to give me his thoughts on the development of computerised learning in the last decade. He joined the firm in 1979; at that time the U.K. schools branch of the publisher had just one micro-computer available to the staff (a 8K PET Machine). He suggested that it was in the early 1980's that it became common for schools to have their own computer; a typical Hertfordshire school at the time would have one 380Z machine. However, the existing software on the market at the time was mainly developed on mainframe computers in the 1970's. Most of it, as already mentioned, was intended for 'A' level groups. Materials such as the Computers in the Economics Curriculum suite certainly fitted this description. These materials were thus amended so that they could be used with microcomputers such as the RML 380Z. By 1983 this publisher, in common with other interested groups, felt that software could be developed which was for a less academic type of group, and which would be designed so that it could be used in a number of different ways. However, for him as a publisher, there was a problem of commercial viability. There are approximately 6500 secondary schools in the U.K. Let us suppose that a firm were to gain 100% market penetration and that every school's economics and business studies department had access to one or more computers. These departments would be unwilling to pay much more than £20 or so for a piece of software. Thus the total maximum revenue from a piece of single-subject software is likely to be in the order of £130,000. Now, if program writers were to cost their time at an economic rate, such a relatively small revenue would be unprofitable. In fact, much software is devised as part of a cottage industry; this publisher did not employ program writers to work full time on his economics and business studies software. That is partly why he is able to publish software for this part of the curriculum; it is sometimes viable due to the small rewards designers often pay themselves.

This problem is all the more acute when one realises that for a publisher, a package selling 1,000 or more copies would be regarded as a bestseller. Typically therefore, it might generate a revenue of £20,000 or perhaps £40,000 (with a selling price of £40). Very few pieces of software actually generate these sums of money, particularly of the subject-specific kind in economics and business studies. One exception is Lumsden's Running the British Economy, which is the best selling title in this area of the curriculum, by some margin.

So users of software are benefitting from a producer-subsiby, in that software writers' time is not being costed accurately. This editor also thought that the DTI scheme of subsidising software purchases, up to 50% of the cost, was also likely to promote sales. This, of course, could be viewed as a consumer subsidy.

A third type of subsidy, also available from the government, was helping to promote the development of CAL materials. It was suggested that projects such as the Computers in the Curriculum were useful because they enabled software writers to be adequately paid whilst they were designing and testing their materials. Many of the recent software titles from this publisher had been subsidised in this way.

This representative suggested that the commercial problems involved with software development had hampered the progress of CAL materials.

Publishers simply could not be sure of the returns to a considerable investment made. He also suggested that revenue was further diminished by the risks attached to copying disks. That is why he suggested there is a current mis-match between the supply and demand for software, particularly in this area of the curriculum. He also explained that in an effort to recoup their costs, they had built even more complicated protection devices into many of their disks. They could now sell disks "on approval" knowing that the risks of copying were less than they used to be.

This editor was kind enough to send me a printout of all the titles that he had published between June 1981 and October 1987 concerned with economics education. It is important to clarify the word title in this context. Many simulations or programs appear more than once on the print out listing because they might be programmed for (say) an Apple computer on one occasion and a BBC computer on another. Using the word title in this sense, between June 1981 and December 1984, he had published 57 titles for this part of the curriculum, and all of them were aimed at VI Formers or similar groups of students: this could be interpreted as the 'A' level market. In the next three years, a further 100 titles were published, and of these, 35 were aimed at the 14-16 old market, i.e. the sub-'A' level category.

Finally, it was suggested that for a variety of reasons, publishers were likely to rationalise their lists of subject-specific software, including those titles currently available for economics and business studies. In future, they would be likely to concentrate their efforts on titles that could be used in a number of disciplines. These titles could then be purchased by a number of departments (in schools or colleges) acting in unison.

In January 1988, a representative of another software publisher was kind enough to see me. Many of his views accorded with those of the first publisher. The second representative also suggested that the educational market for software in the U.K. was a limited one. Only three publishers had enjoyed much success with CAL, amongst the major national publishers. He too accepted that software writing for this part of the curriculum was sometimes of a disappointingly low standard. Many of the titles currently available were from small-scale publishing units; a cottage industry had indeed sprung up, and it was difficult to monitor standards in this industry.

Like the first editor, this second representative believed that publishers were likely to be increasingly interested in more generic software. He suggested that the "shelf-life" of a typical piece of software was approximately 4 years; after that, it had to be scrapped or updated.

He suggested that the climate now (1988) was more receptive to the use of CAL materials, for a number of reasons. Firstly, in common with many writers, he has suggested that there is now an increased emphasis on student centred learning, which often involves students "learning by doing". Many CAL materials can be used to promote this style of learning. He also felt that many schools and colleges had been given a lead by their advisers, who were often increasingly interested in this mode of learning. He mentioned advisers in Hampshire, Hertfordshire and Essex who were promoting the use of CAL materials in economics and business studies. By the same token, one might suggest that the use of CAL materials is extremely patchy. In Hampshire, for example, the recent

BIS scheme has meant an increase in the use of micro-computers compared with other parts of the country.

RESULTS OF THE SURVEY

In this section I wish to discuss the results of the empirical work that I carried out.

Twenty seven copies of the questionnaire (see Appendix 1) were sent to the sample set, which comprised 12 colleges of further education in Hertfordshire. The reply rate was encouraging:18 of the 27 questionnaires were completed and sent back. However, two of these replies came from people who used CAL methods with HNC/HND business studies groups which, since they were not the target group being investigated, were excluded.

Of the other 16 replies, 4 lecturers suggested that they did not use CAL methods whilst teaching economics or business studies. So 12 of the 16 people who replied to the questionnaire used CAL methods at the appropriate level. This is a far higher proportion than that reported by Wood. In his survey, far less than half of the respondents claimed to use CAL methods. These 12 respondents seemed to occupy a broad range of positions: there were 6 Lecturer I replies, 4 Lecturer II replies, one from a Senior Lecturer and one from a Principal Lecturer.

The replies to the third question, concerning the type of software used, were interesting. Most teachers seemed to use either simulations (such as Teddytronic or Sixgam) or data bases/spreadsheets (such as D Base III Ashton Tate UK Ltd, 1985). Only 3 respondents actually claimed to use both types of software. A number of those concerned with business studies teaching used the Pegasus accounting package (Brandt Computer Communications Systems, 1976). These teachers also seemed to be using data base and spreadsheet packages. Typically, such lecturers use these generic types of software with BTEC groups pursuing a National Diploma course that features a compulsory Finance module.

Some of the respondents seemed to be spending most of their time teaching economics, rather than business studies. It was far more likely that such lecturers would use simulations rather than the generic software. However, neither these economics teachers nor their business studies counterparts mentioned using Running the British Economy or Understanding Economics Pack I. Given the popularity and the pre-eminence of these packages, this seems very surprising. It suggests the existence of a 'knowledge gap'. Despite the fact that these respondents knew of some CAL materials and were using them, they had not apparently heard of two very "famous" examples of software in this area of the curriculum. A competing explanation might be that these teachers knew of these software titles, but had chosen not to use them. In fact, when I saw five of these teachers for classroom observation, three of them mentioned that they had not heard of either of these titles.

The twelve respondents in toto represented five of the Hertfordshire colleges. Of these five colleges, four have business studies departments that possess their own computers. All of the respondents who were teaching 5 years ago maintained that their departments had either no computers, or significantly fewer computers in 1983. By 1988, it had

become commonplace for business studies departments in colleges to have access not only to college-wide facilities, but also to their own hardware.

To answer questions 6 and 7 of the questionnaire meant that the respondents had to be teaching five years ago. Nine out of the 12 respondents were able to answer these two questions, but the other 3 were unable to answer them, simply because they were not in the teaching profession in 1983. All of the remaining nine respondents felt that both their departments and their colleges had significantly less hardware 5 years ago.

The next question concerned the type of courses with which CAL had been used. One would have predicted from the literature that courses for able students would be well represented here. It is hardly surprising that 3 out of 5 people who taught 'A' level economics used CAL materials on such courses. Rather surprisingly, two out of these three used CAL methods for less than five hours per student per year. This contrasts with Hurd's estimate that the average 'A' level economics student could expect to have between 6 and 7 hours of CAL per year.

To qualify for most BTEC National courses, students usually have to have either 4 'O' levels (or grade C at GCSE) or some compensating experience. Whilst such courses are perhaps not quite as academic as a typical 'A' level course, they are still demanding. One would usually describe a BTEC group of students as being of 'above average' ability. Thus it is not surprising that BTEC units such as The Organisation in its Environment or the Finance Module were well represented here. Moreover, a BTEC teacher of the option Elements of Banking also claimed to use CAL methods, albeit for less than one hour per student per year.

Other courses with a similar clientele that used CAL methods were the Institute of Administrative Management and a module of a TEC Electronics course entitled 'Economic and Social Issues'. Again, it is significant that, in both cases, CAL methods were used relatively sparingly. The lecturer replying on behalf of the TEC Electronics group maintained that he used CAL methods for between 5 and 10 hours per student per year. It is important to say, however, that his group was an evening class, and teaching time is clearly tightly constrained in such a situation. The (full time) students on the Institute of Administration course could expect to have 12 hours per capita CAL time, per year.

However, the replies did provide some evidence to suggest that CAL methods are being used with students of average or below average ability in this area of the curriculum. One lecturer teaching a GCSE business studies course maintained that his students could expect 20 hours of CAL time per year. Another lecturer maintained that his students pursuing an economic literacy module as part of the CPVE course received between 1 and 5 hours of CAL time per year. Another respondent suggested that students pursuing a National Computing Centre course experienced 15 hours of CAL, whilst pursuing an Accountancy module. Many of these students were on YTS programmes and had few if any formal qualifications, although it is true that they had to pass an aptitude test and an interview to gain acceptance on to the course.

The answers to questions 9 to 17 (inclusive) are presented in Table 1. Questions 10 and 11 were again only answered by 9 respondents, for the reason given above: the other 3 lecturers were not teaching 5 years ago.

Table 1: Responses to Questions 9-17 of Survey (See Appendix 1)

Question	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
9) I find that there is still a real difficulty gaining access to a sufficient number of computers at the right time for use with any given group.	8	3		1	
10) I now use CAL more than I did 5 years ago in this area of the curriculum.	2	3	1	2	1
11) The quality of software for use in economics/business studies has improved in the last 5 years.	1	5	3		
12) The competitive nature of many economics/business studies computer simulations discourages the less able students within any given group.	1	1	5	4	1
13) Female students are less receptive to the use of CAL materials than their male counterparts.		1	4	4	3
14) The most useful software available today for economics/ business studies is of a gaming/simulation nature rather than drill/practice.	2	5	3	1	1
15) In my experience economics/business studies software works best with small groups (i.e. groups of less than 10 students).	4	5		3	
16) CAL lessons serve to motivate the pupils to study the subject more than other methods of teaching.		1	8	3	
17) Using CAL materials is often not the most effective way of teaching a particular concept in terms of time spent	2	5	5		

In this table, question 9 generated the most consensus. Only one person disagreed with the sentiment expressed, i.e. that gaining access to an adequate number of computers at the right time is difficult. This is an interesting response. It suggests that despite the huge growth in hardware alluded to earlier, teachers still find that gaining access to an adequate number of machines is difficult. The colleges surveyed would each seem to possess a number of computers, but teachers of economics and business studies cannot necessarily gain access to this hardware when they want to. This finding was supported by the interviews that I held with 5 respondents. A number of them complained that rooms with a class set of computers were controlled by a computing studies department. Typically such a department would be responsible for allocating the use of its computer laboratories, and would often give a low priority rating to those who taught economics or business studies. Now it is true that such teachers might simply be rationalising their sparing use of such machinery, but that is what they felt. One interviewee complained that priority was often given to short courses funded by outside agencies (such as local firms, or the Training Commission) and his own full-time BTEC group rarely used computers for this reason. The respondent argued that the college concerned would rather maximise its revenue by guaranteeing access to hardware for those (short) courses that could charge a fee.

Question 15 also generated considerable agreement amongst those who replied. Nine of the twelve respondents agreed that software works best with small groups of students. Again, this finding concurs with both the classroom observations and the interviews that I undertook. I suspect that for logistical reasons, teachers would prefer to allow students the freedom to experiment using CAL methods, if they are working in a relatively small group. A number of interviewees felt that when a large number of students used CAL methods, it was harder to control. This is interesting because it suggests that this sample set of teachers liked to hold a "tight rein" on their lessons; they felt uneasy if they were not directly able to supervise or "keep an eye on" the students in their group. Ironically the very nature of CAL work is that it is designed frequently to allow students greater autonomy and they frequently respond well to such an opportunity.

Perhaps the most surprising responses in the survey were those to question 16. Eight out of the twelve respondents said they were uncertain whether CAL methods really did serve to motivate their students. This conflicts with the findings of American writers as well as the work of Wood. Only one person agreed with the suggestion that "CAL lessons serve to motivate the pupils to study the subject more than other methods of teaching". I think this might be due to the nature of the software used. Many of those replying to this question were used to using generic types of software, such as data bases or spreadsheets. The findings cited earlier were often concerned with simulation exercises or, in the case of American writers, programmed learning exercises. Certainly the three simulation exercises that I actually observed seemed to generate a considerable degree of student interest. Perhaps the teachers concerned felt that other teaching strategies they employed served to motivate the students equally well. In any event, this result is quite surprising.

The replies to question 17 were by no means unanimous, but nevertheless a discernible theme emerged in the suggestion that CAL methods were generally expensive in terms of time used to teach a particular concept. Again, this questionnaire finding is consistent with

the interviews that I had with five of the respondents. Broadly speaking, they welcomed the advent of student-centred learning and the emphasis on the acquisition of skills rather than students having to memorise content-heavy courses, for recall in timed examinations. However, they all said that although CAL methods fitted in with the prevailing ethos of 'new' courses (such as GCSE) or revised courses (such as BTEC), they were expensive in terms of time taken.

Another surprising result came in answer to question 13, about CAL and female students. Wood suggested that female students were less receptive to the use of CAL than their male counterparts. Other writers reached conclusions that are consistent with Wood's findings. Hurd, for example, found that there was a significant gender difference with regard to CAL. This difference could not solely be explained by the numerical superiority of male to female entrants to economics examinations. Those teachers who were interviewed denied that female students were less likely to benefit from CAL lessons. However, one is tempted to suggest that a gender difference may be occurring here, of which teachers are unaware. For example, in one business studies class that I observed, I noticed that although the students were engaged in a range of activities, it was generally the male students who used the computers, to interrogate a data base. The female students spent most of their time on non-computerised tasks, such as preparing overhead transparencies for the talks they were due to give the following week. I pointed out this gender difference to the teacher afterwards. He expressed surprise at this finding, but on reflection he agreed that this was indeed the case.

I now wish to consider the replies to question 10 and 11 together: both questions are concerned with changes in CAL over the last 5 years. Again, one could suggest that this may not have happened; it is merely what these teachers think has happened. Nevertheless, their views are important in this context, because they are likely to influence the actions of the teachers concerned. Moreover, all nine respondents who answered these questions were experienced teachers who had been using CAL for some time. Most of the respondents felt that the quality of software had improved, but that did not necessarily mean they used CAL methods significantly more often. The replies to question 10 indicate some increase in the use of CAL, but three of the nine respondents disagreed with the statement, "I now use CAL more than I did 5 years ago in this area of the curriculum".

The interviews that I conducted tended to support this argument. The five teachers interviewed generally felt that modern software was "more fun to use" and likely to be more beneficial than the "first wave" of software, developed in this country in the 1970's/early 1980's. However, they also felt that although their colleges had more hardware than they did 5 years ago, gaining access to this hardware was difficult. These interviewees suggested that today's software was more user-friendly, took advantage of colour graphics and enhanced processing power to make for more useful programs. On the other hand, logistical difficulties prevented these teachers from using this software as often as they would like. The result was that, although these teachers used CAL more than they did 5 years ago, this was a slight rather than vast increase.

Perhaps the most disagreement between respondents was expressed in the answers to questions 12 and 14. More people disagreed with the sentiment expressed in question 12, than agreed with it. However, there were 5 uncertain replies here, and one must be especially careful about formulating any overly confident assessment of the data generated by this

question. The impression is that on balance the teachers disagreed with the idea that CAL simulations are predominantly for the more able student.

Some of the teachers interviewed felt that it was important to establish the context within which less able students were working. If one had, say, a large and heterogeneous BTEC group, then it might be the case that the comparatively less able students would feel intimidated by their very able counterparts. Most BTEC students are of average or above-average ability, for the reason given earlier, i.e. that most of them have 4 or more 'O' levels, as an entry requirement to get on the course. Clearly, though, it would still be possible to have a heterogeneous BTEC group. This situation might contrast with a class of YTS students following a low-level City and Guilds course that would predominantly cater for the below-average ability range. In this latter case, less able students might find themselves in a group that was reasonably homogeneous. Given this situation, these students might not be so hostile to the idea of playing some simulation, because they would know that they would not have to compete against able students, who would be placed in a different teaching group.

The literature seems to suggest that until recently, less able students have in general terms been less well catered for, in terms of CAL provision. They are less likely to gain access to hardware, and much of the "first wave" software really works best with homogeneous able groups. Moreover, Wood suggested that within a given able group, such as a typical 'A' level class, the brighter students were likely to benefit more than their slower, albeit quite able, counterparts. If one looks at the Computers in the Curriculum materials, they are desigfned for 'A' level groups; Wood is suggesting that using the suite with heterogeneous 'A' level students is difficult. The quicker students within such groups will tend to dominate any discussion about decisions to be taken and will grasp the point of any given simulation before their peers have "got inside the model". He is suggesting that to play such simulations with a mixed group is difficult. The less able students often feel undermined because they have little or no chance of doing well, or contributing much to a given simulation.

The evidence from question 12 tempts one to suggest, tentatively, that teachers do not accept that computerised simulations are purely for the more able students in this part of the curriculum. Moreover, this finding was supported by the interviews that I conducted. Teachers suggested that there are a number of computer simulations now, such as Teddytronic, that can be enjoyed by groups of less able students. These teachers also felt that logistically it was possible to set up such simulations for a given group, so that more able students were not necessarily playing directly against less able students. In this situation, the less able students did not necessarily feel threatened at the prospect of losing to, or being embarrassed by, their able counterparts.

Question 14 was one of only 3 questions that gained both a 'strongly agree' and 'strongly disagree' answer. On balance, there is some slight evidence to suggest that teachers agreed that "The most useful software available today for economics/business studies is of a gaming/simulation nature rather than drill/practice". Several teachers, when interviewed, said they were slightly puzzled by this question; after all, in this part of the curriculum there are few examples of programmed learning packages. One such example is "The Phillips Curve", (Jennett and Reynolds, 1985). One teacher who had used this package, with an 'A'

level group, thought that there were some occasions when such students needed a certain amount of drill and practice in order to do well in the 'A' level examination. In general terms though, he too agreed with the sentiment of the question. On reflection, I feel that this was probably the least useful question in the questionnaire. It might have been more interesting to compare generic software with subject-specific simulations, in terms of their 'utility-rating' by teachers.

LESSONS OBSERVED

I wish now to make some general comments about the CAL lessons that I observed. One feature that emerged from most lessons was that the teacher had a supportive rather than directive role in the lesson. Typically, he would outline the purpose of the lesson and would issue such instructions as were necessary to use the software. This procedure would often take 15 minutes or so, at the beginning of the lesson; after that, students were left to work on their own. Thus, a devolved style of working emerged in these lessons, with students working in pairs or small groups of three or four. Again, in most cases, these groups were non-directed; students paired off themselves, or went into groups of their own choosing.

There was one notable exception to this picture outlined above. In one National Computing Class that I observed, 8 students operated their own microcomputers individually, but were given precise instructions from the teacher concerned, at each stage of the accounting procedure being investigated. The students were allowed very little autonomy in this lesson, except in so far as they operated the keyboards themselves. Partly as a result, I suspect that they derived little benefit from that lesson. The teacher concerned had no teaching qualification, or previous experience; instead he had recently come from a local firm, having had a background in management accounting. He obviously understood the Pegasus package used; talking to his students, I did not get the impression that they understood the purchase ledger being examined that day.

Another characteristic that emerged from these observations was that there seemed to be a gender difference in terms of students' experiences of CAL. In common with other writers in this field, I suspect that female students are not benefitting from CAL as much as their male counterparts. To some extent, this reflects the imbalance of those that enter for economics/business studies courses. On a typical 'A' level economics or BTEC course, there will be more males than females. Two of the groups I observed were all-male, and a TEC Electronics group had just one female student out of a group of eight. Moreover, all of the groups observed were taught by a man. Two of the groups observed comprised a number of female students, but even here it was noticeable that male rather than female students would usually operate the computers. However, this was by no means a "hard and fast" distinction; female students did use the computers in these groups, albeit less frequently than their male counterparts. In one BTEC lesson I observed, students had formed themselves into small groups, to play the simulation Sixgam. Some of these groups comprised all-female students. In this case, clearly, at least some female students had to operate the computer.

A wide variety of groups were observed. Possibly the most academic comprised 4 male students pursuing an 'A' level economics course. By comparison, I also observed 16 students pursuing a GCSE business studies

course. The impression I have is that software is now being developed that can be used to good effect with able and less able students. Moreover, in a heterogeneous group (such as the BTEC class I observed with 26 students) there is no reason why the less able should necessarily feel threatened by their more able counterparts, whilst playing a simulation.

It would seem that organising a large class of 26 students presents especial difficulties if one is to use CAL methods. Certainly when I interviewed the teacher who gave that lesson, he felt that CAL lessons worked better with small groups. Logistically, the smaller classes that I observed (with 4 or 8 students) presented fewer difficulties, as one might expect.

Three simulations were observed, together with one accounting package and one data base. In terms of student motivation, it would seem that computer simulations do capture the players' interest, for the most part. Certainly the students whom I witnessed playing Teddytronic or Yes, Chancellor, seemed to enjoy the exercises. Similarly, those business studies students who used the data base Inform (Nottinghamshire Computer Educational Support Service, 1986) also seemed to enjoy that lesson. Conversely the N.C.C. students who used the Pegasus package seemed largely indifferent to it. This may have been due to the mode of usage or because that package was unsuitable for that particular group of students.

Of course, it is quite possible to imagine that students might enjoy a computer package without necessarily believing that it is furthering their understanding of the material to be mastered on a given course. The TEC students (undertaking the Teddytronic simulation) seemed to take this view. By contrast, students pursuing the GCSE business studies, 'A' level and BTEC courses alluded to, felt that the programs they were dealing with were both useful and enjoyable. Of course one is entitled to the view that these students are not necessarily qualified to make informed assessments of various pedagogic alternatives, but again, I feel that their views on such matters will influence their behaviour.

The most purposeful of the lessons that I observed seemed to be those in which the teacher had been careful to 'link up' the CAL work with future work, or ideas that had preceded the CAL lesson.

TEACHER INTERVIEWS

I wish now to consider some points that emerged from the interviews that I had with the five teachers who gave the observed classes. These interviews were held after the lesson concerned, and a number of the main points have already been covered. I wished to investigate some of the issues raised by the questionnaire in more depth. These findings have been discussed above. I also wished to raise some further issues that did not readily lend themselves to question-format on a questionnaire.

One point to emerge was that all of the teachers felt they did not have time to investigate adequately those software titles that are on the market. The teacher who used the Pegasus package used that piece of educational software because it was the only one with which he was familiar. He felt he did not have the time or inclination to spend many hours considering other alternatives that may have become available. All of the teachers agreed that some more INSET training should be given to

help teachers become more aware of the software available.

Most of the teachers interviewed also agreed that having discovered an interesting piece of software, it took some time before one learned how to derive the maximum benefit from the program. There seemed to be a consensus that one beneficial aspect of much CAL was that it encouraged student autonomy. This student-centred learning was itself desirable, but it could be more difficult to manage, particularly if one had a large group who had to get through a content-heavy syllabus.

Four of the five teachers interviewed suggested that changes in assessment patterns had helped to promote the use of CAL. All of these teachers agreed that the change from O/CSE examinations to the 'new' GCSE would be likely to encourage the use of CAL. CAL methods were thought to fit in well with the GCSE ethos of learning by doing. Moreover, the emphasis of many GCSE courses centres around the development of skills such as data-handling: the teachers interviewed thought that CAL could be useful to develop such skills. Several teachers also remarked on the sudden rise in popularity of the dual-certificated Hampshire business studies course. It was felt that this course could also be instrumental in terms of increasing the number of hours of CAL that students experienced in this part of the curriculum. Those teachers concerned with BTEC felt that the Finance module was likely to be taught increasingly often with the aid of computers, as more appropriate software became available. They also felt that the requirement to incorporate the rise in Information Technology, (in The Organisation in its Environment module) was likely to promote the use of CAL.

Despite these comments, the teachers interviewed did not foresee that they were likely to be using much more CAL in the near future. They would have liked to do so, but logistical difficulties would, they argued, prevent a vast increase in the use of CAL. Now these teachers could have been rationalising, i.e. they might have felt that they ought to be using much more CAL, but were not prepared to make the effort to make sure this happened. However, this is not the impression I gained. These teachers all talked cogently about both the benefits of CAL and the difficulties of gaining access to the hardware. Moreover, this discussion point was consistent with the results of the questionnaire survey (see the replies to question 9 and 10).

CONCLUSIONS

Initially I advanced the hypothesis that there have been very great changes in CAL vis-à-vis economics and business studies courses over the last five years. I suggested that significant changes had taken place in terms of the quantity and quality of computer hardware and software available for use in this area of the curriculum. Such changes had occurred quite rapidly, in keeping with many other developments in computer-related activities. Moreover these developments have taken place in the context of more general educational change that has occurred in the U.K. in the 1980's. The switch from 'O'/CSE examinations to the new GCSE; the advent of CPVE courses; the growth of Open Learning and the change in many BTEC courses were all highlighted as significant developments that were consistent with the theme that CAL could be more useful now than it was five years ago. However, I also accepted that whilst CAL might be more potentially useful in courses up to and including 'A' level, it remained true that as yet it is a teaching resource that has been used sparingly. Nevertheless I wished to suggest that CAL might well be of more potential benefit than it was in 1983.

To test this hypothesis, it was clearly necessary, at least in part, to collect some data in an attempt to find out whether (or how) CAL was being used in the classroom. Most of the empirical data came from a small scale questionnaire study. Only 18 replies to this questionnaire were received, and two lecturers had used CAL methods at HNC level, which was considered outside the scope of the investigation.

One major weakness of questionnaire studies is that the respondents might well reply in the way that they think they ought to, rather than in a way that would be consistent with their own behaviour. I therefore attempted to 'back up' the questionnaire findings with a number of classroom observations and subsequent interviews with the teachers concerned. Logistically this also proved to be more difficult than I had anticipated. The task of finding a time during which a teacher used CAL with a given group that I could observe proved to be a troublesome one. That is why only five classroom observations (and teacher interviews) were undertaken.

One of Wood's conclusions was that CAL tended to suit the more able student. This conclusion was echoed by those involved in geography education in the early 1980's. Moreover, the CAL packages that were published in the late 1970's/early 1980's (in this part of the curriculum) were primarily intended for the 'A' level market. As a result of this study, I would suggest that a wider range of software is now available; some of this software is 'aimed at' the average and below average ability pupil. Certainly it is true that software is now designed for a wider range of courses.

The change in software has come about partly because of important changes that have occurred in the nature of the hardware available. Microcomputers today have an increased memory capacity; increased processing power; better colour graphics facilities and are more user-friendly than the 380 Z machine that featured in Wood's survey. One RML 380Z was the only microcomputer available in Wood's school in 1983. I faced a similar situation in the Hertfordshire school in which I worked at this time. Indeed, it was standard policy in that county to have one such machine per school in the early 1980's.

This brings us to another important development in the 1980's. Wood mentioned that the possibility of a school's economics department having its own computer was no more than a dream. It is becoming increasingly common for such departments to have their own machines. Certainly in further education colleges, it seems to be the norm that the business studies departments should have their own machines. Five years ago, this was not the case. In real terms, the cost of purchasing a microcomputer has diminished rapidly; this has meant that such hardware is now increasingly available to those who might wish to use it.

Wood's paper pre-dates many important educational initiatives of the 1980's. In the early 1980's, assessment patterns in schools were dominated by 'A' level or CSE/'O' level examinations. CPVE or GCSE courses had not been introduced at that time, either in schools or colleges. Moreover, many colleges had not felt the need to alter radically their BTEC courses, since the validating body concerned had yet to put widespread pressure on such colleges to re-align and re-assess their Diploma or Certificate courses. In the past five years, many colleges have had to make a conscious effort to integrate the various modules of their BTEC courses more closely. In terms of assessment, they have been increasingly interested in monitoring the acquisition of skills such as data handling; in many cases this has meant doing away with the 'old-fashioned' unseen 3 hour examination, during which students were expected to regurgitate memorised facts.

The five lecturers that I interviewed felt that these developments were important. They also felt that they had been forced to alter their teaching styles to some extent. Broadly speaking, they welcomed the increased emphasis on student-centred learning. They also felt that CAL methods could, potentially, be used to develop the sort of skills that were being carried out. In this respect they felt that the recent appointment of an HMI (in Hertfordshire) who was to deal with business studies was important. The person concerned had a background in information technology, and some lecturers felt that this might also promote the use of CAL in this area of the curriculum. One of the publishers interviewed also felt that there had been encouragement at HMI level, to use CAL, in this part of the curriculum.

The evidence above might be cited to support the argument that CAL is more useful now than it was in 1983. Some of Wood's reservations about the use of CAL should perhaps be re-assessed in the light of the developments mentioned. However, I found some evidence to suggest that there are other conclusions reached by Wood that are still valid today. One of these concerns the benefits that female students may or may not gain as a result of using CAL. Wood suggested that his female students were less receptive to the use of CAL. His conclusion is echoed in much of the literature about CAL, both in this area of the curriculum and in others. In answer to the questionnaire, there was a lot of disagreement with the suggestion that, "Female students are less receptive to the use of CAL materials than their male counterparts". Only one lecturer (out of 12) agreed with this sentiment. However, I still suspect that there could be a gender difference in terms of students' experiences of CAL. Two of the five classes observed were all male, and a third had just one female student (out of a total of eight students present). There was some evidence to suggest that male students tended to use the computer more than their female counterparts in the other two lessons I observed. Interestingly, the two lecturers concerned with their business studies classes were not aware that there was any difference between male and

female students' use of the microcomputers available. One of them was very surprised at my observation but accepted, on reflection, that his male students had indeed used the computers more often that their female peers. During this GCSE lesson, students were working in small groups preparing material for a presentation the following week. The female students had mostly chosen, of their own volition, to carry out non-computerised tasks such as preparing OHP slides. The lecturer concerned admitted that in his questionnaire he had disagreed with the idea that female students were less receptive to CAL. It is tempting to suggest that teachers would like to believe that there is no gender difference here, when in fact there might well be.

The question that received the greatest degree of unanimity was number 9. Only one person disagreed with the sentiment that "I find that there is still a real difficulty gaining access to a sufficient number of computers at the right time for use with a given group". This is interesting, because it suggests that despite today's increased quantity of hardware, teachers still feel that gaining access to microcomputers is difficult. Wood suggested that if an economics department were to have its own computer, then this "dream" would promote the use of CAL. However, five years later, with a much greater number of machines available, this appears not to be the case. It is possible, of course, that teachers are simply rationalising their own sparing use of CAL.

Wood also suggested that CAL works best with small groups. This is a conclusion that would still seem to be valid. Most of the respondents to the questionnaire agreed with this argument. Moreover, the evidence collected from the classroom observations and interviews with teachers also tend to support this conclusion. When I saw 27 students using the simulation Sixgam, there were very acute logistical difficulties which were largely attributable to the size of the group. It is possible that as teachers become more familiar with CAL, they will learn how to incorporate such a weapon into their teaching repertoire more readily even with large groups. At the moment, though, one is forced to suggest that Wood's conclusion here is still valid. Moreover, this fact is almost certainly hampering the usefulness of CAL. It seems to be regarded as a teaching weapon that one can only use with the "luxury" of a small group.

Wood suggested that there might well be cognitive gains to be had, as a result of using CAL, but these might only be relatively slight when compared to other teaching methods. The major argument in favour of using CAL was not to be found in terms of any inherent superiority in making a concept clearer to the students; the two simulations he used could not demonstrate any such superiority. Instead, Wood suggested that his students enjoyed using CAL and this was, itself, a major benefit of such a teaching weapon. Wood suggested that CAL can be used as a motivating device, to stimulate the students' interest in the subject. The conclusion is mirrored in the work of several of the American authors that have been cited, together with that of those writers concerned with geography education in this country. However, the evidence that I have collected is not consistent with such a conclusion. Only one respondent agreed with the idea that, "CAL lessons serve to motivate the pupils to study the subject more than other methods of teaching". This conflict of views could be ascribed to at least two causal factors. It is possible that students today have become much more familiar with microcomputers than they were in 1983. Thus it seems quite likely that any novelty value that CAL may have had in 1983 might have become less prevalent by 1988.

Another explanation centres around the type of software used, together with the context in which it was used. Many of those replying to my questionnaire worked in business studies departments. They were often inclined to use generic software rather than subject specific simulations. Wood's work was specifically concerned with the latter type of CAL. In the 1980's, very few, if any, economics teachers were using computerised data bases or spreadsheets, at the academic level concerned. It may well be the case that students enjoy using computer simulations more than these other types of software. It is certainly true that the students enjoyed playing the three simulation exercises that I witnessed. On the other hand, the group whom I saw using Pegasus largely seemed bored by the exercise they were required to do. This could, of course, simply reflect the way that the teacher had used the package.

One can say that several changes in the CAL available have occurred since Wood collected his data. Whilst some of the conclusions he reached are still valid today, I wish to suggest that many of the changes referred to have made CAL more useful, potentially at least, than it was in 1983. Strictly speaking one ought to say that some of the difficulties that Wood perceived about the use of CAL have been mollified or have simply disappeared. That is not quite the same as suggesting that CAL is inherently more useful. One could take an extreme negative view and suggest that there are fundamental problems with CAL that have not been resolved. Moreover, one could argue forcefully that research has still to be carried out which would evaluate CAL in a rigorous fashion and conclude that it had a comparative advantage when compared to other teaching methods. One could hold this view and still admit that changes had occurred.

I accept that the case for CAL has yet to be proved conclusively and also accept that there are fundamental criticisms that one could level at much of the software that is available today. However, I think the negative view is too extreme. I do believe that the changes that have occurred are significant rather than marginal.

However, one has to conclude that more research is needed into this area. Perhaps even more importantly, we need to establish the theoretical groundwork that would be necessary to evaluate CAL. Very little work has been done in this country to evaluate CAL thoroughly. In a sense this is hardly surprising, since to evaluate the competing claims of different teaching methods is notoriously difficult. Both in this country and in America, those rare evaluation studies that have been carried out at the appropriate level are characterised by two major factors. Firstly, there is a heavy reliance on the use of multiple choice tests as a means of measuring the cognitive gains that might accrue from the use of CAL. This is at best a somewhat imperfect measuring rod. Very often in economics or business studies, one might wish to qualify a statement, or be sure to establish a particular nuance in one's argument. Such subtlety is often difficult to attain when asking or answering multiple choice questions. One could also be forgiven for thinking that issues in economics had one, and only one, objectively correct answer, if one relied too much on the use of multiple choice tests.

Evaluation studies of CAL have also been characterised by a kind of "tunnel vision". Typically, they have focussed on the attainment (or otherwise) of a particular concept or model. Given the multiplicity of uses to which CAL can be put, together with the emphasis on the attainment of skills (such as data handling), that characterises many

courses today, this tunnel vision seems particularly inappropriate. It is possible that economics educators in the U.K. might usefully glean some ideas from their U.S.A. counterparts in this respect.

However CAL is evaluated in the future, two further pertinent points must be made. There is a wide range of CAL on the market at the moment and any evaluation study must be broad enough to take account of this. When Wood did his evaluation, the Computers in the Economics Curriculum suite was undoubtedly a market leader in this area of the curriculum. In the early 1980's that suite, together with Running the British Economy, dominated CAL usage in this area of the curriculum. Now, in the late 1980's there is a range of software titles available to the interested user. Nowadays, I think it is less true to say that the market is dominated by one or two titles, as was the case five years ago.

Just as there is a broader range of software titles now, so I suspect there is an increasing awareness of the possibilities to which CAL can be put. That is certainly the impression I obtained from interviewing several of my colleagues in Hertfordshire. Most admitted that they were still feeling their way towards the best use of the programs that they already possessed. They certainly felt that they were more confident about organising and presenting a CAL lesson than they were previously. For the most part, they also felt that they were now more able to use CAL lessons as a springboard, from which to launch further work and assignments. Any evaluation study of the CAL now available will have to take account of the wide, and widening, range of uses to which it is being put.

Even if such methodological difficulties could be overcome and the advantages of CAL were to be clearly established, it is a moot point whether teachers would use such a tool much more often. One could perhaps at best say that CAL was of more potential benefit. The evidence that I have collected in this county is consistent with Hurd's survey, which was much larger in terms of the number of replies he received. It seems that a typical economics or business studies student can expect a handful of hours of CAL per year.

This may change in the future; several of those interviewed felt that the Hampshire Business Studies project might promote CAL usage. However, the evidence from the questionnaire and interviews does not support the view that there is likely to be a massive increase in the "take-up" of CAL in the next few years.

One of the problems alluded to by several interviewees concerns teachers' lack of knowledge. There seems to be an information gap in respect of CAL. The fact that none of the questionnaire respondents mentioned the Running of the British Economy surprised me, given that program's widespread sales. All of these teachers were experienced in general terms and had had several years experience of using CAL, and yet three of them had not heard of this "famous" program. This information gap seems to be overlooked by certain U.K. writers, such as Hurd, but I am convinced it exists.

One of the authors of that program had some interesting points to make about the "take-up" of CAL, during a recent lecture. Lumsden suggested that many teachers do not necessarily know what software is available today. Given that these teachers are often not sure of the benefits of CAL, they are not always prepared to use their scarce time to find out what programs exist, or what they are capable of achieving.

Lumsden suggested that many teachers are very apprehensive about using CAL. Many of them do not wish to display their ignorance about the capacity of the hardware or the nature of the software in front of others. This can often lead to an unwillingness to experiment and find *out about CAL.

I agree with Lumsden. If one accepts the force of this argument, it follows that INSET training is required, if we are to take advantage of what CAL has to offer. Dade has outlined a similar argument, in favour of more INSET courses for CAL. Teachers need to be given the right conditions to find out about, and experiment with, CAL. This in turn implies, as Dade has suggested, that they are given guidance and advice in the right setting. Once such teachers have seen how to use the software available, then they might have the confidence to use it for themselves, back in their schools and colleges. If more INSET courses are not forthcoming, then there is a real danger that CAL could be the preserve of the few.

A recent article by Davies and Minogue (1988) was very gloomy about the development of more software titles in this area of the curriculum. They suggested that to develop good software needs a very large investment in terms of time put in by skilled personnel. The evidence is that such investment may well not be forthcoming in the future. My impressions concur with this article. Having interviewed two major software publishers, I am convinced that they are somewhat apprehensive about the financial returns to CAL. Both of these publishers suggested that to write good CAL is expensive, and yet the returns to this investment were uncertain. That is why both of them suggested that they might well reduce the range of subject specific titles available.

One could refer to the CAL of the 1970's and early 1980's as "first wave" or "first generation" software. By contrast the CAL of the past five years might be referred to as "second wave". The difference is that the first wave of materials was largely developed by computer enthusiasts who were "casting around" for various topics that could be taught by means of such machines. The second wave of software has generally proved to be more successful. This is because it has a different background and raison d'être. Generally speaking this software has been developed because those with classroom teaching experience had a particular problem that they wished to tackle. They felt that CAL materials might help them to deal with such a problem.

It would be optimistic to think that as computer hardware improves and becomes more powerful that a third wave of materials might be developed. At the moment one has to say that the outlook for the widespread development and use of such a third wave is gloomy. Publishing houses are uncertain of the returns to software development, and this is one of the major factors that is hampering the development of CAL. Moreover, given the existence of an information gap referred to earlier, it is doubtful that teachers would necessarily "take up" the new materials.

There is another reason to be very apprehensive about the development of CAL in this country. I suspect that a kind of inertia may be affecting those who already possess CAL materials. The BBC microcomputer has been the "standard issue" for many schools and colleges

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*This lecture was given at the 1988 Economics Association Conference held in April, at Caerleon, Wales.

in Hertfordshire in the last few years. A range of software titles have been written for this machine in this and other areas of the curriculum. Moreover many of the 1970's materials such as the Computers in the Economics Curriculum suite have been adapted for use with BBC machines. Some teachers have built up a library of software titles, that will run on BBC machines. Even if these teachers knew of new software titles that could perform a range of tasks, it is very doubtful that they would necessarily buy that software, if it was designed for the next generation of hardware. For many teachers, the idea of scrapping their existing software and buying a new library that would run on new and more powerful machines seems to be a luxury they cannot afford. In this sense they are "locked into" a technology that already seems out of date to many computer specialists.

It would seem as though software writers will have to be very careful about the programs they write, in the near future. One possibility is that they might well write software that could be used by a number of different departments. This might enable them to write attractive CAL that could take advantage of some of the possibilities that the new hardware has to offer. It is likely that these materials would be more expensive than a typical economics or business studies title that might retail at £40 (or so) at present. However, if the cost of the software were to be shared between a number of departments, this might not prevent them from buying that enhanced program, despite a higher retail price.

The switch from subject specific to generic software has been alluded to several times. The evidence from this study suggests that this is a trend that is particularly prevalent in business studies teaching. In future, though, it is quite likely that the economics specialist may well find that there are fewer subject specific simulations that are available to him/her.

This switch has further implications for the research that needs to be done in this area. It has already been suggested that there is a paucity of literature in this country that has concerned itself with the evaluation of CAL. Those few evaluation studies that have been carried out have, in this country, concerned themselves with simulation exercises; in the U.S.A. evaluation studies have often been concerned with programmed learning packages. Future research will have to concern itself with generic software that is used in this area of the curriculum.

Appendix 1

QUESTIONNAIRE ON COMPUTER AIDED LEARNING IN ECONOMICS AND RELATED SUBJECTS

Part 1

Details of Teacher/Equipment Involved

1) Your Post: . . . . . .
2) Do you currently use any software in your economics/business studies courses? If the answer is no, then please ignore the rest of this questionnaire.
3) Which pieces of software have you used in this area of the curriculum, below degree level?
4) What computer hardware is available within your department? Please specify makes, and numbers, of main frames/micro computers, if possible.
5) What other computer hardware is available for your use, elsewhere in the college and "outside" your own department?
6) Five years ago, did your department own:
   - significantly more
   - significantly less
   - approximately the same

   number of computers?
7) Five years ago, did your college own:
   - significantly more
   - significantly less
   - approximately the same

   number of computers?
8) SEE ATTACHED SHEET.

For each of the courses listed below, please specify the amount of CAL your students would typically receive in terms of hours per year. The second column represents those courses that you do teach, but on which you do not use CAL; please be sure to tick this column whenever appropriate.

	0	Less than 1 hr	Between 1 and 5 hrs	Between 5 and 10 hrs	Above 10 hrs (please specify approx how many)
A/Level Economics					
GCSE Economics					
A/Level Business Studies					
The Organisation in its Environment					
Economic Literacy (CPVE)					
Economic Literacy (Personal/Life Skills)					
Economics (Return to Study)					
Economics (Access)					
Economic Aspects (City & Guilds Courses)					
Any Other (please specify)					

Part 2

Survey of Teachers' Attitudes in Hertfordshire F/E Colleges

Please tick whichever column most closely corresponds to your own views vis-à-vis the statements made on the left-hand side of the page.

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
9) I find that there is still a real difficulty gaining access to a sufficient number of computers at the right time, for use with any given group					
10) I now use CAL more than I did 5 years ago, in this area of the curriculum.					
11) The quality of software for use in economic/business studies has improved in the last 5 years					
12) The competitive nature of many economics/business studies computer simulations discourages the less able students within any given group					
13) Female students are less receptive to the use of CAL materials than their male counterparts					
14) The most useful software available today for economics/business studies is of a gaming/simulation nature rather than drill/ practice					
15) In my experience economics/business studies software works best with small groups (i.e. groups of less than 10 students					
16) CAL lessons serve to motivate the pupils to study the subject more than other methods of teaching					
17) Using CAL materials is often not the most effective way of teaching a particular concept in terms of time spent.					

Any other comments - about CAL in economics/business studies - that you would be prepared to write in the space below, would be warmly appreciated.

N.B. No use will be made of replies which could subsequently result in the identification of any particular individual or establishment.

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